BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

(12) UK Patent Application (19) GB (11) 2 201 318 (13) A

(43) Application published 24 Aug 1988

(21) Application No 8703217

(22) Date of filing 12 Feb 1987

(71) Applicant
UDI Group Limited

(Incorporated in United Kingdom)

Denmore Road, Bridge of Don, Aberdeen, AB2 8JW

(72) Inventor
Mervyn Neil Jackson

(74) Agent and/or Address for Service
Boult, Wade & Tennant,
27 Furnival Street, London, EC4A 1PQ

(51) INT CL⁴
H04R 17/00

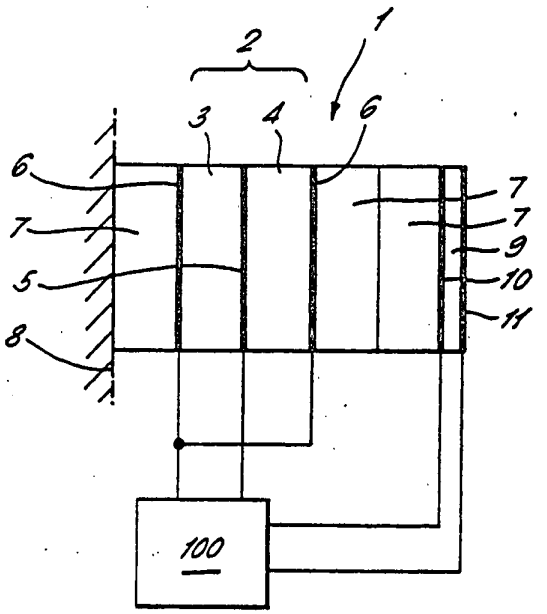
(52) Domestic classification (Edition J):
H4J 30F 30H 30L 30N 31J AAX
G1G ED

(56) Documents cited
GB A 2157914 GB A 2148504 GB 1534842
GB 1031145 GB 1016115

(58) Field of search
H4J
G1G
Selected US specifications from IPC sub-class
H04R

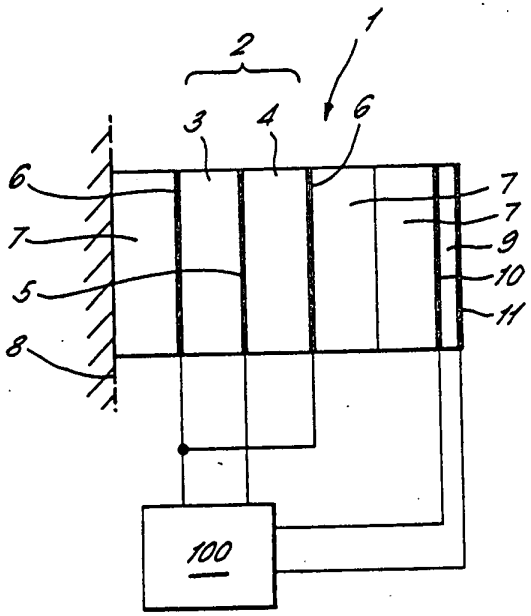
(54) Electromechanical transducer

(57) An electromechanical transducer comprises an oscillatory body (1) having a piezoelectric oscillatory element (2) with associated electrodes (5, 6), sandwiched between filled epoxy matching elements (7). The output face of the body (1) carries a layer (9) of plastics piezoelectric material with associated electrodes (10, 11). The layer (9) provides a signal which is supplied as a feedback signal to control the output of the transducer, whereby the transducer can be self-regulating making it ideally suited for use in transducer arrays.



The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.

1/1



2201318

ELECTROMECHANICAL TRANSDUCER

This invention relates to an electr mechanical transducer.

Many forms of electromechanical transduc r are known and they are used for many purposes, for example medical ultrasonic scanning, non-destructive testing using sound waves, underwater sonar, ultrasonic cleaning of workpieces, and many other purposes.

Some known transducers comprise an oscillatory body having an output face from which sound waves are derived, the body being formed of an oscillatory element, for example an element of piezoelectric material with associated input electrodes, and one or more matching elements carried by the oscillatory element and serving in use to match the output of the transducer to the medium at the output face thereof. The oscillatory element can be of piezoelectric material having the electrodes in the form of metal layers deposited thereon.

In underwater sonar apparatus a plurality of such tranducers are often used in any array, it then being necessary for the output of each transducer to be set relative to the outputs of all th other transducers in the array in order for an intelligable picture to be obtained with the apparatus. Such setting of the transducers is generally carried out using a detector arranged to receive the output of the transducer array, each transducer in the array being operated individually and its output determined with the detector, the transducer being adjusted until the required output is obtained.

Clearly this is a laborious, time consuming and thus expensive operation to carry out.

According to this invention there is provided an electromechanical transducer comprising an oscillatory body having an output face and a layer of piezoelectric material with associated electrodes at said output face and serving in use to provide an output signal indicative of the output of the transducer.

With the transducer of this invention the layer of piezoelectric material at the output face will give an output signal directly indicative of the output of the transducer, which output signal can be used to control the transducer, possibly automatically, to give the required output.

The layer of piezoelectric material is preferably thin so as to have minimal effect on the output of the transducer. However, with transducers as described above having matching elements the layer of piezoelectric material can itself constitute the or the outer matching element, in which case its thickness will be dependent upon the effect it is required to have on the output of the transducer.

The piezoelectric material used is preferably a plastics material, for example polyvinylene-difluoride (PVDF) since such materials are less brittle than ceramic materials.

An electromechanical transducer according to this invention will now be described by way of example with reference to the drawing which is a diagrammatic sectional side view of the transducer with associated components.

The transducer comprises an oscillatory body 1 having an oscillatory element 2 formed of a pair of piezoelectric material members 3 and 4 having metal electrodes 5 and 6 between them and on their outer surfaces. The members 3 and 4 can be of piezoelectric ceramic material such as

lead-zirconate-tintanate as sold as PZT 4 or PZT 5. The electrodes 5 and 6 can be provided in known manner by any suitable metal deposition technique. The outer electrodes 6 are commoned and an input signal applied between electrodes 5 and 6 effects oscillation of the members 3 and 4. Although the oscillatory element 2 shown comprises two members 3 and 4, a single member element of known form can otherwise be used.

The members 3 and 4 are arranged in a stack with a plurality of matching elements 7 formed of filled epoxy material, there being a single element 7 on one side of the element 2 and serving to mount the transducer on a support surface 8 and two elements 7 on the other side of the element 2. The matching elements 7 serve in known manner to match the output of the transducer to the medium, for example water, at the output face 8 thereof in order to achieve effective coupling between the transducer and the medium.

As thus far described the transducer is of conventional construction.

As shown, the output face of the transducer is covered with a layer 9 of plastics piezoelectric material, for example PVDF, having output electrodes 10 and 11 on its opposite surfaces. The layer 9 is relatively thin and dimensioned to have minimal effect on the output of the transducer. The layer 9 is responsive to oscillation of the body 1 caused by the element 2 and provides an output lectric signal between its electrodes 10 and 11 indicative of the output of the transducer. This output signal is supplied as a feedback signal to the energizing circuit 100 for the transducer where it is used to control energisation of th transducer in order to obtain a required output.

The transducer can thus be self regulating, although if required the output signal from the layer 9 can be used to give an indication to an operator so that manual control of the transducer can be effected.

The transducer described above has the advantage that when a plurality thereof are used in an array as used for underwater sonar, each transducer can be self-regulating simultaneously with all the other transducers, there being no need for sequential individual setting to obtain a required composite output.

Although in the transducer described above the layer 9 is relatively thin, as previously discussed the layer 9 can otherwise constitute a matching element for the transducer in which case it will be relatively thick in order to have the desired effect on the output of the transducer.

CLAIMS

1. An electromechanical transducer, comprising an oscillatory body having an output face and a layer of piezoelectric material with associated electrodes at said output face and serving in use to provide an output signal indicative of the output of the transducer.

2. A transducer as claimed in Claim 1, in which the body comprises an oscillatory lement with associated input electrodes and one or more matching elements carried by the oscillatory element and serving in use to match the output of the transducer to the medium at the output face thereof.

3. A transducer as claimed in Claim 2, in which the layer of piezoelectric material constitutes the or the outer one of the matching elements.

4. A transducer as claimed in Claim 2 or Claim 3, in which the oscillatory element is of piezoelectric material.

5. A transducer as claimed in Claim 4, in which the oscillatory element is of plastics piezoelectric material.

6. A transducer as claimed in any preceding claim, in which the output signal from th piezoelectric material layer is used for automatic control of the output of the transducer.

7. An electromechanical transducer substantially as hereinbefore described with

reference to the drawing.

8. A transducer array comprising a plurality of transducers each as claimed in any preceding claim.

Amendments to the claims have been filed as follows

CLAIMS

1. An electromechanical transducer in the form of an oscillatory body comprising an oscillatory element of piezoelectric material with associated input electrodes and having an output face with a layer of piezoelectric material with associated electrodes at said output face and serving in use to provide an output signal indicative of the output of the transducer.

2. A transducer as claimed in Claim 1, including one or more matching elements carried by the oscillatory element and serving in use to match the output of the transducer to the medium at the output face thereof.

3. A transducer as claimed in Claim 2, in which the layer of piezoelectric material constitutes the or the outer one of the matching elements.

4. A transducer as claimed in any preceding claim, in which the oscillatory body is of plastics piezoelectric material.

5. A transducer as claimed in any preceding claim, in which the output signal from the piezoelectric material layer is used for automatic control of the output of the transducer.

6. An electromechanical transducer substantially as hereinbefore described with reference to the drawing.

7. A transducer array comprising a plurality of transducers each as claimed in any preceding claim.

Published 1988 at The Patent Office, State House, 66/71 High Holborn, London WC1R 4TP. Further copies may be obtained from The Patent Office.